WHAT IS CLAIMED IS:

1. A method for manufacturing p-type nitride semiconductor comprising:

a semiconductor layer forming process for forming a low resistivity p-type nitride semiconductor layer on a substrate held at a temperature of 600°C or higher by introducing p-type dopant source, nitrogen source and Group III source on said substrate, and

a cooling process for cooling the substrate bearing said p-type nitride semiconductor layer; wherein

The hole carrier concentration of said p-type nitride semiconductor layer decreases during said cooling process.

2. The method for manufacturing p-type nitride semiconductor recited in claim 1, wherein the decrease rate of said hole carrier concentration is 0% - 95%.

3. The method for manufacturing p-type nitride semiconductor recited in claim 1 or claim 2, wherein said cooling process contains a procedure during which the substrate is cooled from the substrate temperature in said semiconductor layer forming process to 600°C within 30 min.

4. The method for manufacturing p-type nitride semiconductor recited in claim 1, 2 or 3, wherein the atmosphere in said semiconductor layer forming process contains hydrogen for 5% - 70% in capacity percent.

5. The method for manufacturing p-type nitride semiconductor recited in claim 1, 2, or 3, wherein the atmosphere introduced during a procedure, in said cooling process, for cooling a substrate from substrate temperature in said semiconductor layer forming process to 600°C contains hydrogen for 0% - 50% in capacity percent.

6. The method for manufacturing p-type nitride semiconductor recited in claim 1, 2, or 3, wherein the atmosphere introduced during a procedure, in said cooling process, for cooling a substrate from said substrate temperature in said semiconductor layer forming process to 600°C contains ammonia, NH_3.

7. A method for manufacturing p-type nitride semiconductor comprising:

a p-type nitride semiconductor layer forming process for forming a low resistivity p-type nitride semiconductor layer on a substrate held at a temperature of approximately 950°C or higher by introducing p-type dopant source, nitrogen source and Group III source on said substrate, and

a cooling process for cooling the substrate bearing said p-type nitride semiconductor layer; wherein

said substrate is cooled during a procedure, in said cooling process, for cooling said substrate from approximately 950°C to approximately 700°C, under certain specific combinations of the hydrogen concentration in atmosphere and the cooling time where the p-type nitride semiconductor layer can maintain the low resistivity property.

8. The method for manufacturing p-type nitride semiconductor recited in claim7, wherein

the combination of said hydrogen concentration in atmosphere and said cooling time falls within a region specified by points A - B - C - D - E - F, in an X - Y coordinate, X axis representing said hydrogen concentration (%) in atmosphere, Y axis representing said cooling time (min.); where, the point A(50, 1. 0), point B(30, 1. 8), point C(10, 4. 1), point D(0. 15), point E(0, 0. 5) and point F(50, 0. 5).

9. A method for manufacturing p-type nitride semiconductor comprising:

a p-type nitride semiconductor layer forming process for forming a low resistivity p-type nitride semiconductor layer on a substrate held at a temperature of approximately 950°C or higher by introducing p-type dopant source, nitrogen source and Group III source on said substrate, and

a cooling process for cooling the substrate bearing said p-type nitride semiconductor layer; wherein

said substrate is cooled at the vicinity of approximately 800°C, in said cooling process, under certain combinations of the hydrogen concentration in atmosphere and the cooling rate, where the p-type nitride semiconductor layer can maintain the low resistivity property.

10. The method for manufacturing p-type nitride semiconductor recited in claim 9, wherein

the combination of said hydrogen concentration in atmosphere and said cooling rate falls within a region specified by points O - P - Q - R - S - T, in an X - Y coordinate, X axis representing said hydrogen concentration (%) in atmosphere, Y axis representing said cooling rate (°C/ min.); where, the point O(50, 250), point P(30, 140), point Q(10, 61), point R(0. 17), point S(0, 500) and point T(50, 500).

11. A p-type nitride semiconductor grown on a substrate at a temperature of 600°C or higher, wherein the hole carrier concentration immediately after the cooling equals to approximately 5% - 100% of the hole carrier concentration at said growth temperature.

12. A p-type nitride semiconductor grown on a substrate at a temperature of 600°C or higher, the upper surface of said p-type nitride semiconductor being exposed, wherein

the hydrogen concentration at the vicinity of upper surface of said p-type nitride semiconductor equals to 1 - 10 times that in the inside of said p-type nitride semiconductor.